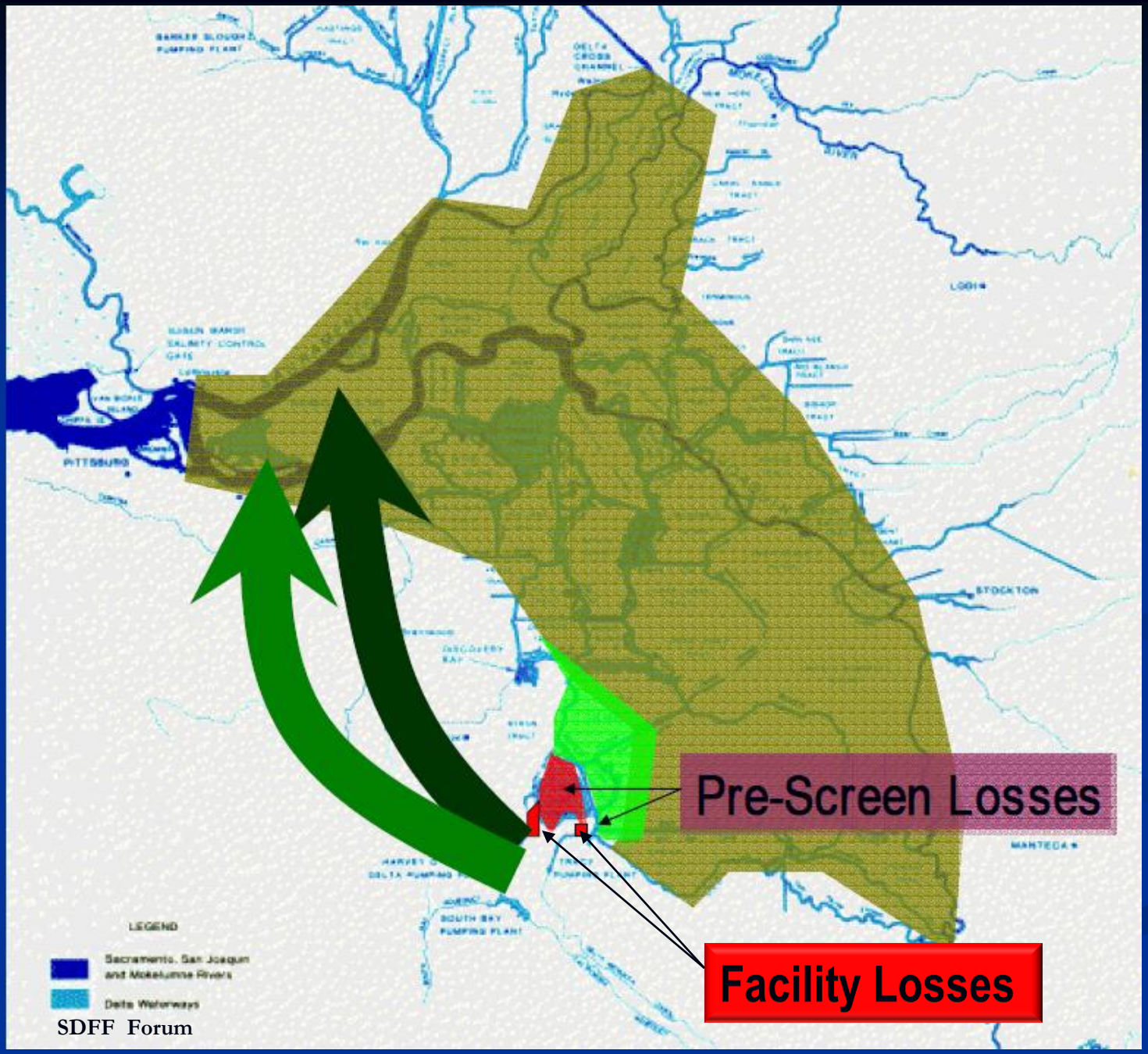
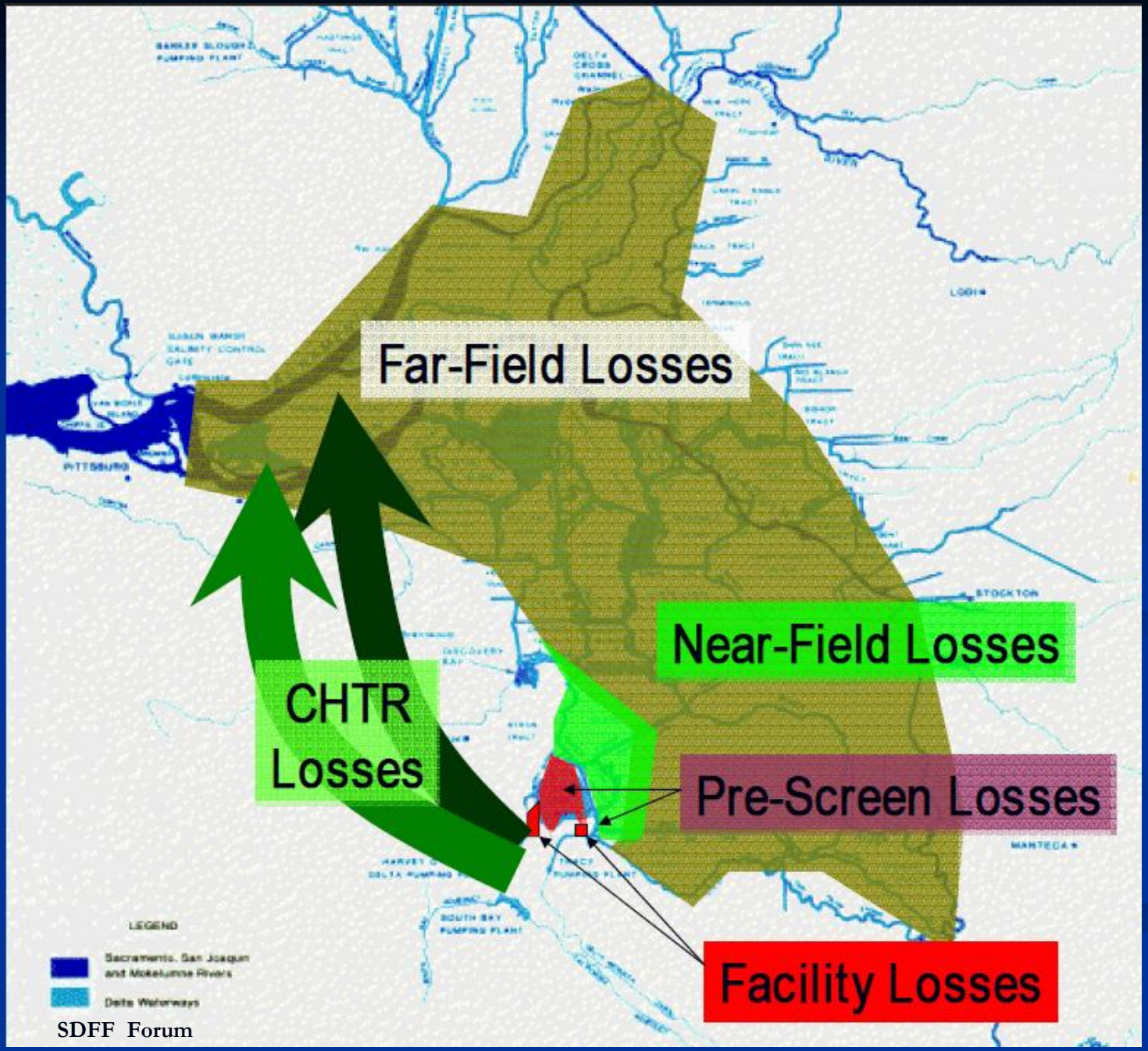
Initial Evaluation of Entrainment Losses For Delta Smelt in the State Water Project

by

USFWS, DFG, FCCL/UC-Davis
& Collaboration by USBR, DWR



http://calwater.ca.gov/content/Documents/meetings/SDFF/April2_2003/SD_Influence_Map_4-2-03.pdf



http://calwater.ca.gov/content/Documents/meetings/SDFF/April2_2003/SD_Influence_Map_4-2-03.pdf

Introduction

Purpose:

Evaluate efficacy of mark-recapture tests to ensure a feasible approach to quantify the extent of entrainment losses of delta smelt in the south Delta

Introduction

Purpose:

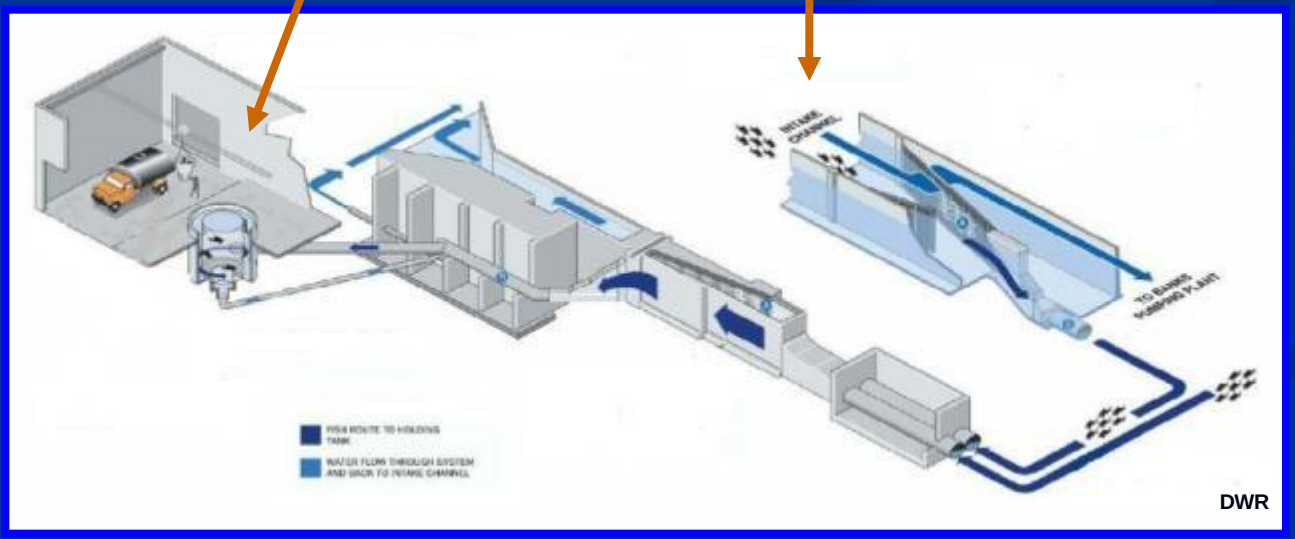
Evaluate efficacy of mark-recapture tests to ensure a feasible approach to quantify the extent of entrainment losses of delta smelt in the south Delta

Objectives :

1) **Develop and evaluate marking method for delta smelt**
2) **Initial estimates of Skinner Fish Facility efficiency**
3) **Initial estimates of pre-screen loss in CCF**

Clifton Court Forebay

Skinner Fish Protective Facility



Research Questions

- **Marking method development for delta smelt:**

  Feasibility of marking juvenile and adult delta smelt (survival, mark retention)

Research Questions

- **Marking method development for delta smelt:**

  Feasibility of marking juvenile and adult delta smelt (survival, mark retention)

- **Initial field estimates of entrainment losses at SWP:**

1. **Salvage Efficiency of delta smelt at the Skinner Fish Facility**
2. **Percent Recovery of delta smelt for releases in CCF**
3. **Pre-Screen Loss for delta smelt in CCF**

<u>Fish Facility Efficiency</u> = % marked fish recaptured at the Skinner Fish Facility of the total number of marked fish released at the trash rack (in front of the primary louvers)

Where:

$$FFE = 100\frac{TRrec}{TRrel}$$

FFE = Fish facility efficiency

TRrec = number of recaptured marked fish that were released at trash rack

TRrel = number of marked fish released at trash rack

Fish Facility Efficiency = % marked fish recaptured at the Skinner Fish Facility of the total number of marked fish released at the trash rack (in front of the primary louvers)

Where:

$$FFE = 100\frac{TRrec}{TRrel}$$

FFE = Fish facility efficiency

TRrec = number of recaptured marked fish that were released at trash rack

TRrel = number of marked fish released at trash rack

Percent Recovery for fish released at the radial gates in CCF = % marked fish recaptured at the Skinner Fish Facility of the total number of marked fish released at the radial gates.

$$PR = 100\frac{RGrec}{RGrel}$$

Where:

PR = Percent recovery

RGrec and **RGrel** are as previously defined

$$PSL = 100\left[1 - \left\{\left(\frac{RGrec}{RGrel}\right)\left(\frac{1}{0.01FFE}\right)\right\}\right]$$

<u>Pre-Screen Loss</u> in Clifton Court Forebay (CCF) = % marked fish lost in CCF of the total number of released fish at the radial gates, excluding fish facility losses.

$$PSL = 100\left[1 - \left\{\left(\frac{RGrec}{RGrel}\right)\left(\frac{1}{0.01FFE}\right)\right\}\right]$$

Where:

PSL = Pre-screen loss

RGrec = Number of marked fish recaptured at Skinner Fish Facility that were released at the radial gates

RGrel = Number of marked fish released at radial gates

FFE is as defined earlier

METHODS

Source of Delta Smelt: UC Davis Fish Culture & Conservation Lab

Marking:

Calcein (5 minutes immersion: 5 g/l adults, 2.5 g/l juveniles)

Photonic adult marking (dorsal, caudal, anal fins)

Transgenerational marking (30 ppt Sr chloride hexahydrate)

METHODS

Mark-Recapture Experiments:

Adult Releases: Skinner Fish Facility & radial gates: Feb & Mar 2009

2 to 4 photonically marked groups per site & month

Juvenile Releases: Skinner Fish Facility & CCF:

2 calcein marked groups :west and center CCF (Jun 2008)

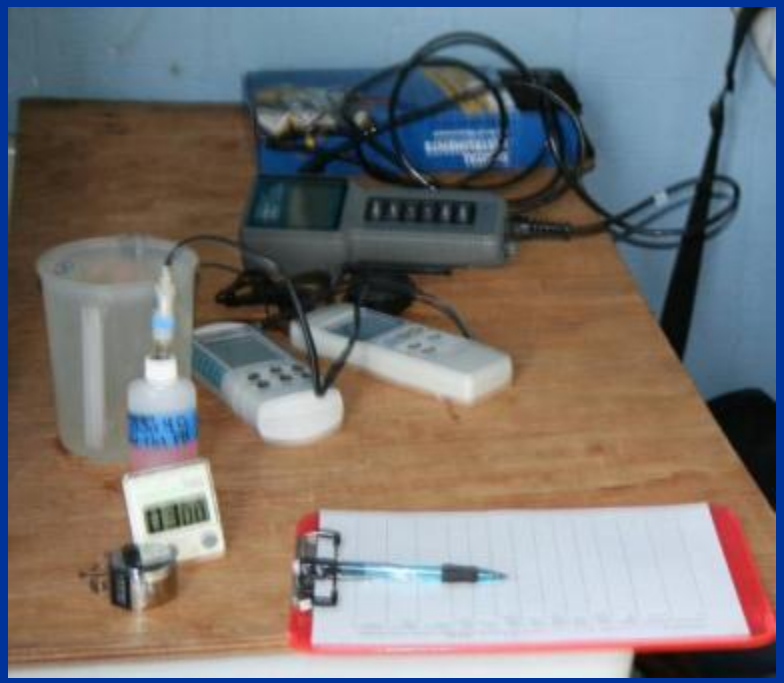
1 calcein marked group : radial gates (Jun 2009)

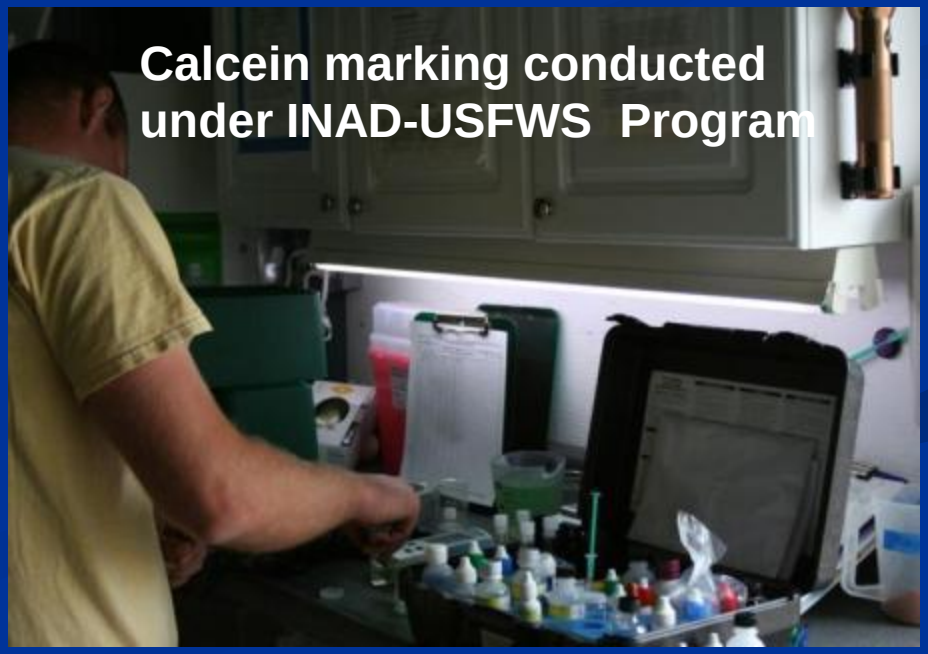
Assumptions

- Marked fish are recognized as such and reported
- Mark is retained throughout the entire study period
- No differences in mortality between marked and unmarked fish

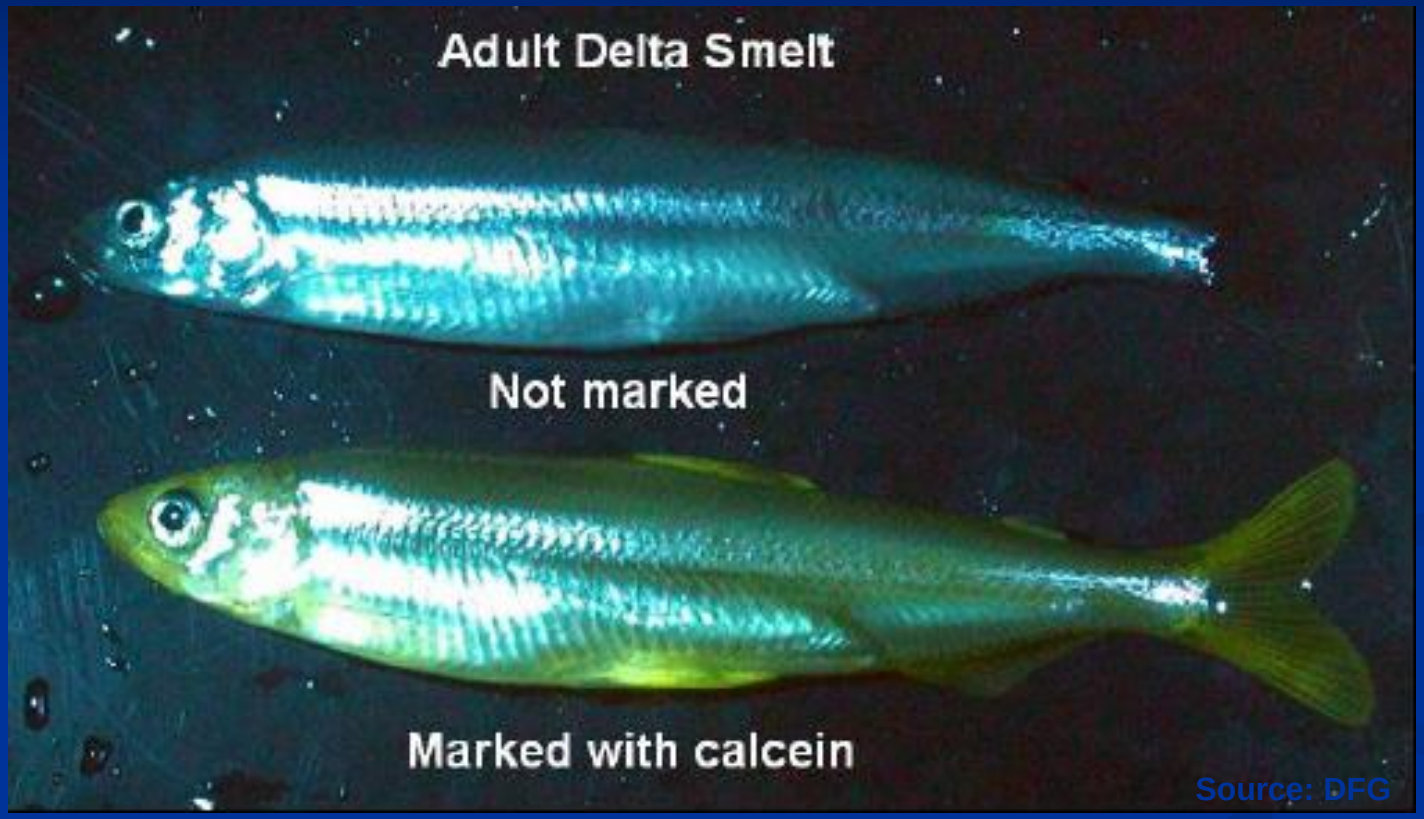

Juvenile Rearing


Adult Rearing




Calcein marking conducted
under INAD-USFWS Program

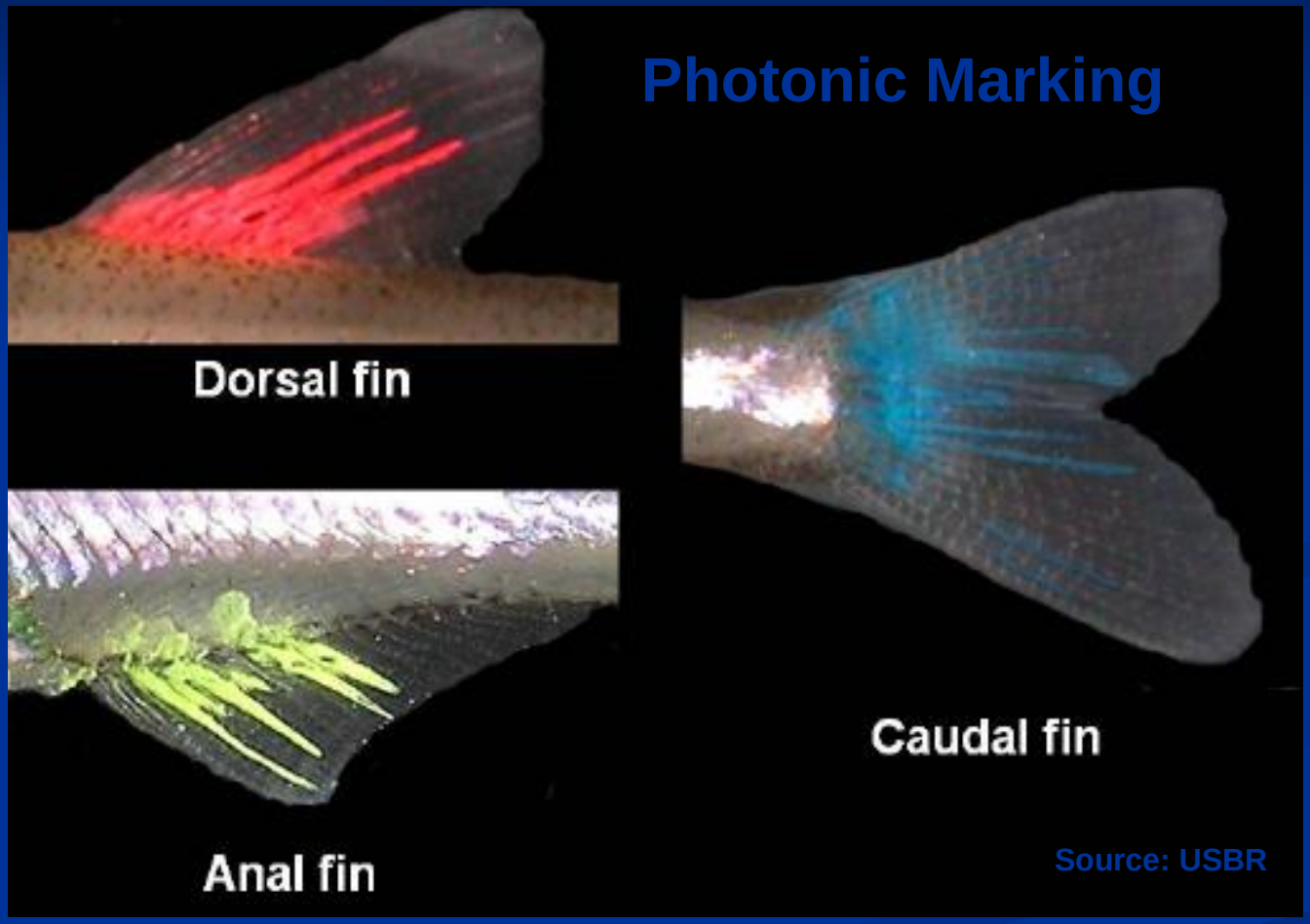
Calcein Marking


Adult Delta Smelt
Not marked
Marked with calcein
Source: DFG

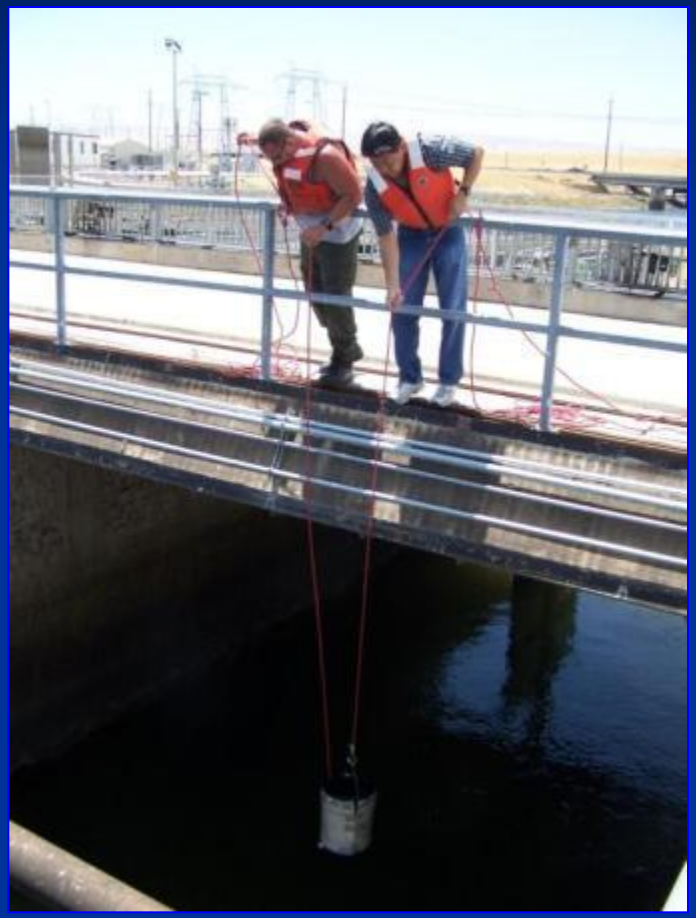
Calcein Mark Detection

Secondary Photonic Marking for Adult Delta smelt

Photonic Marking



Trash Rack Release

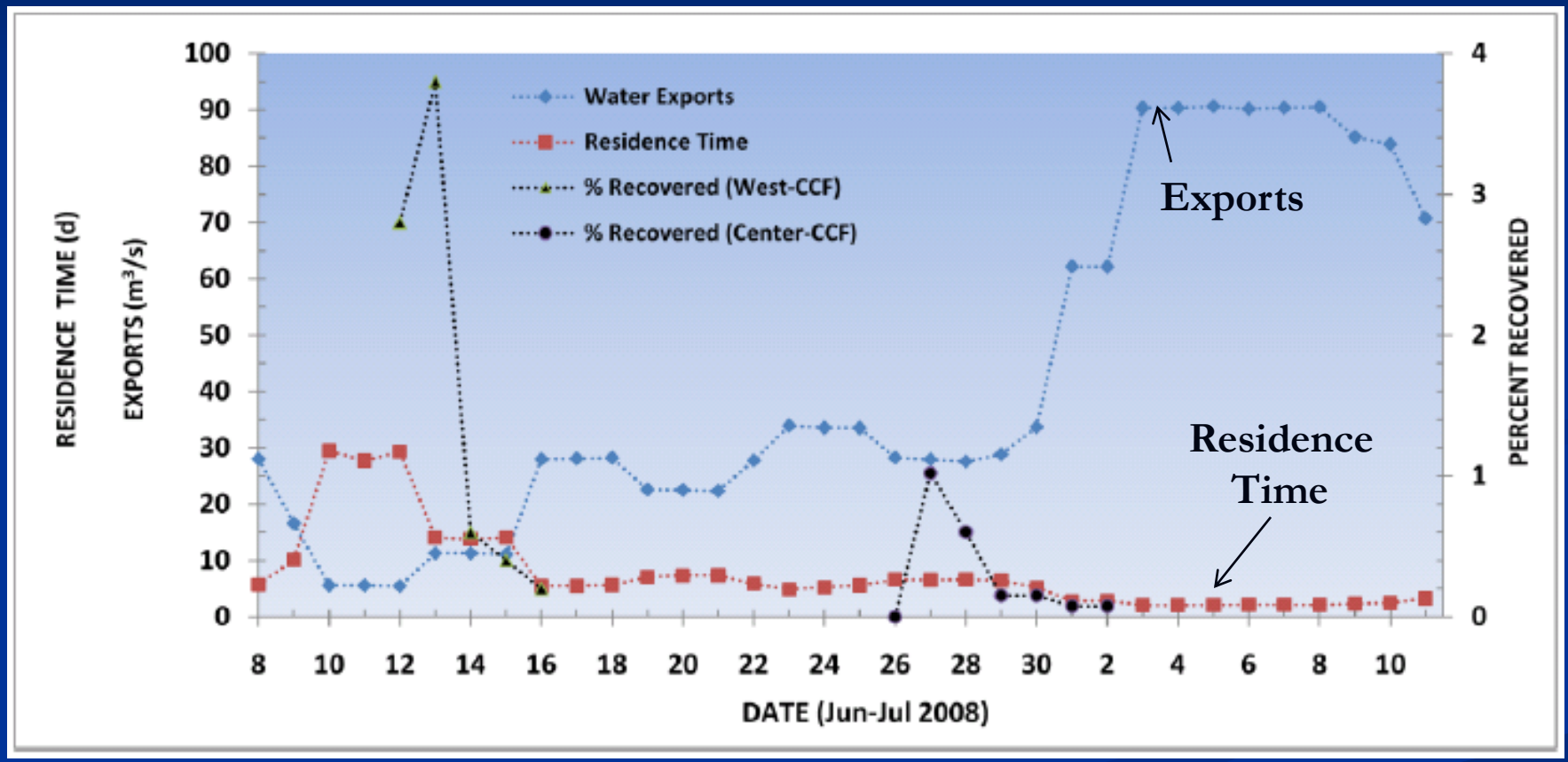


Clifton Court Forebay Releases

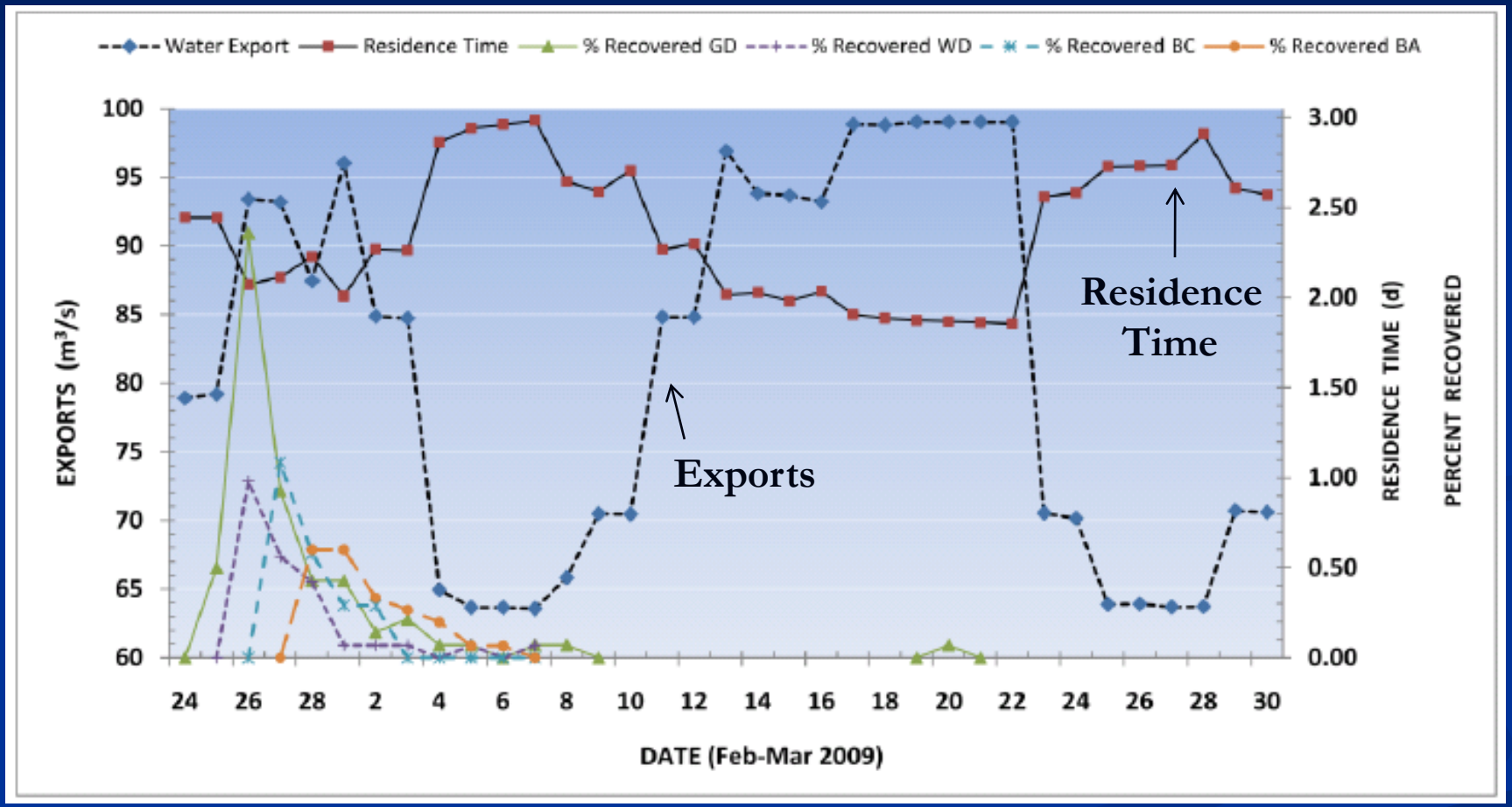
Regular Counts

Total Census

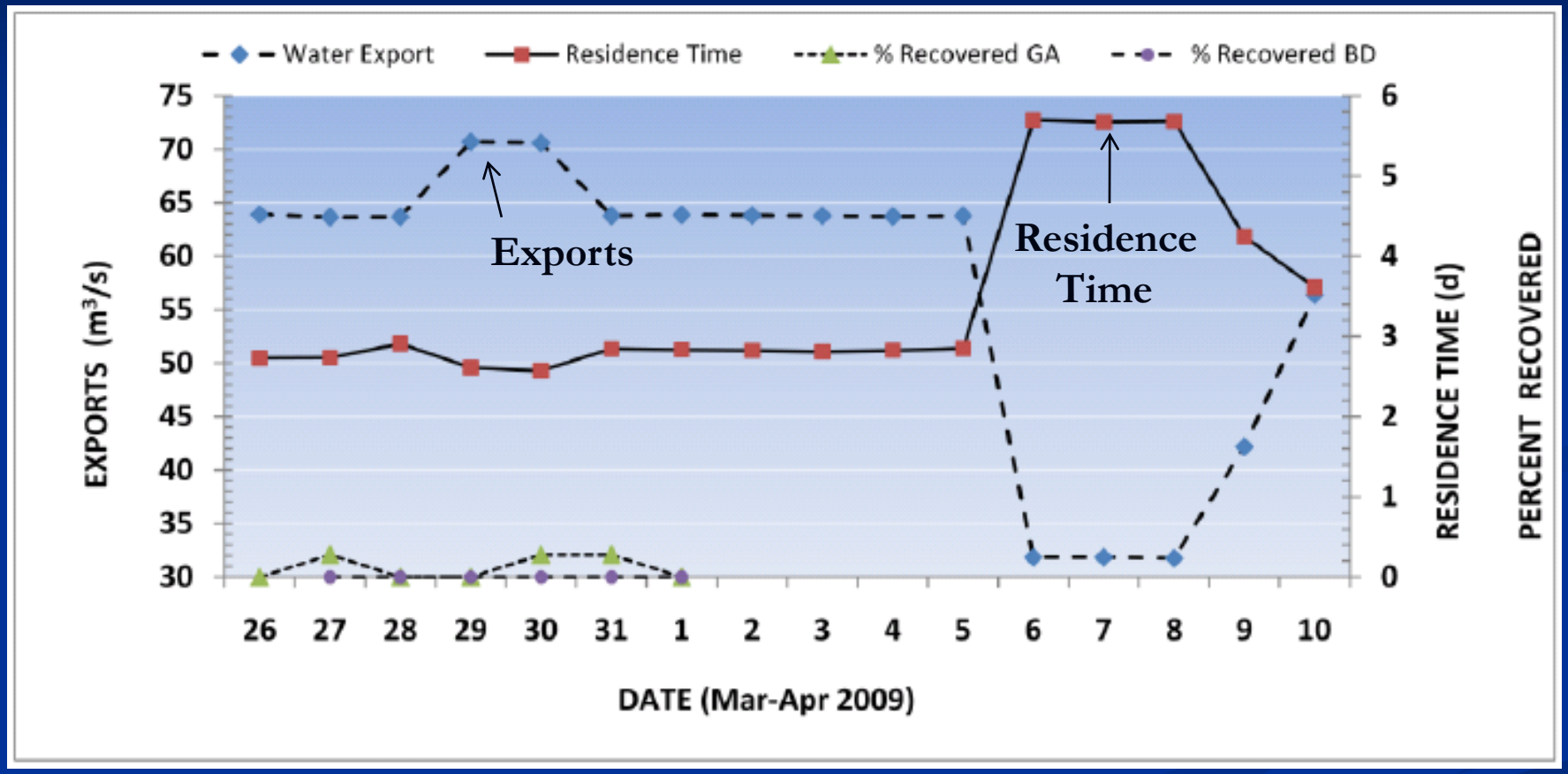
Juvenile Experiments June 2008



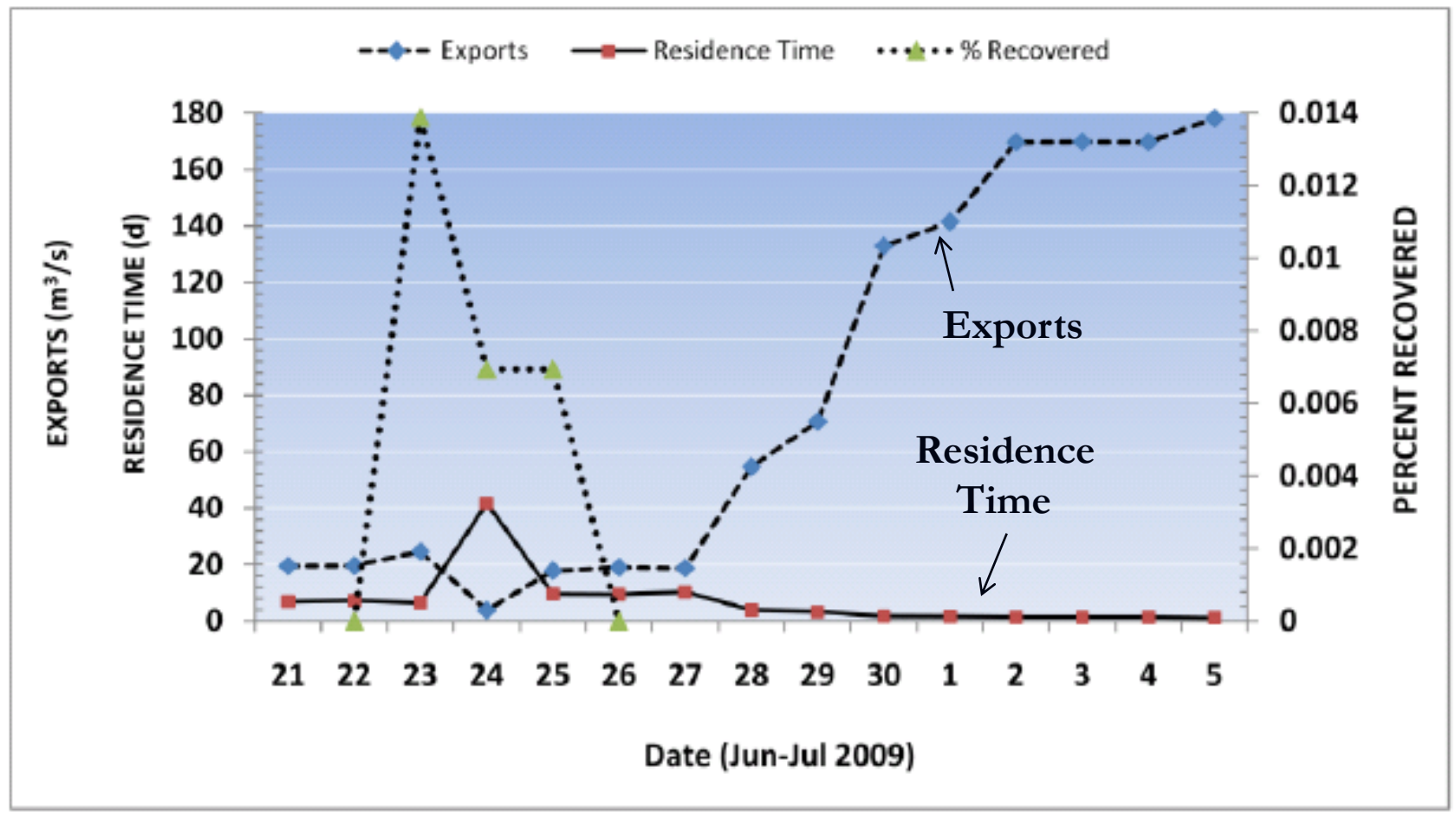
Adult Experiments February 2009



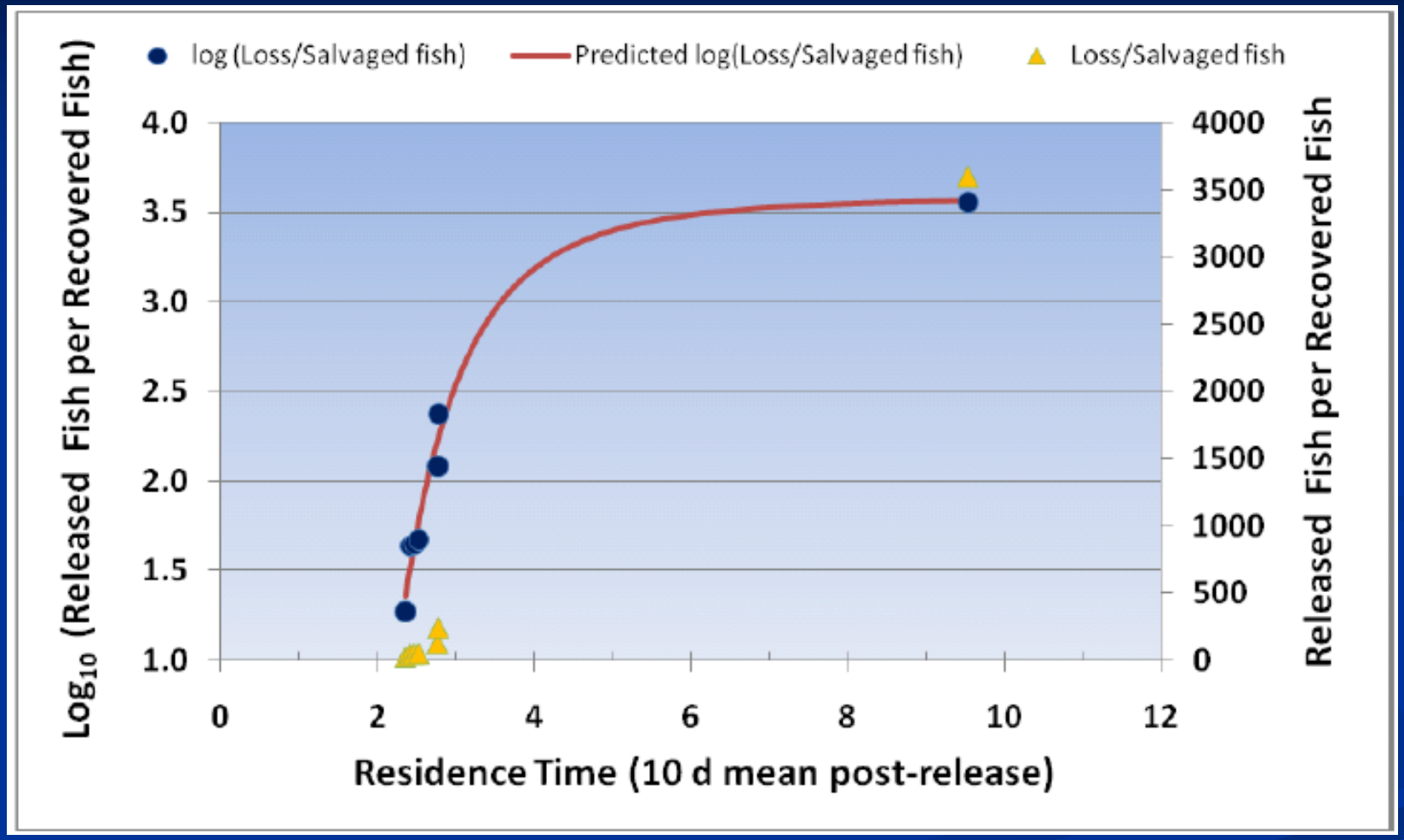
Adult Experiments March 2009



Juvenile Experiments June 2009

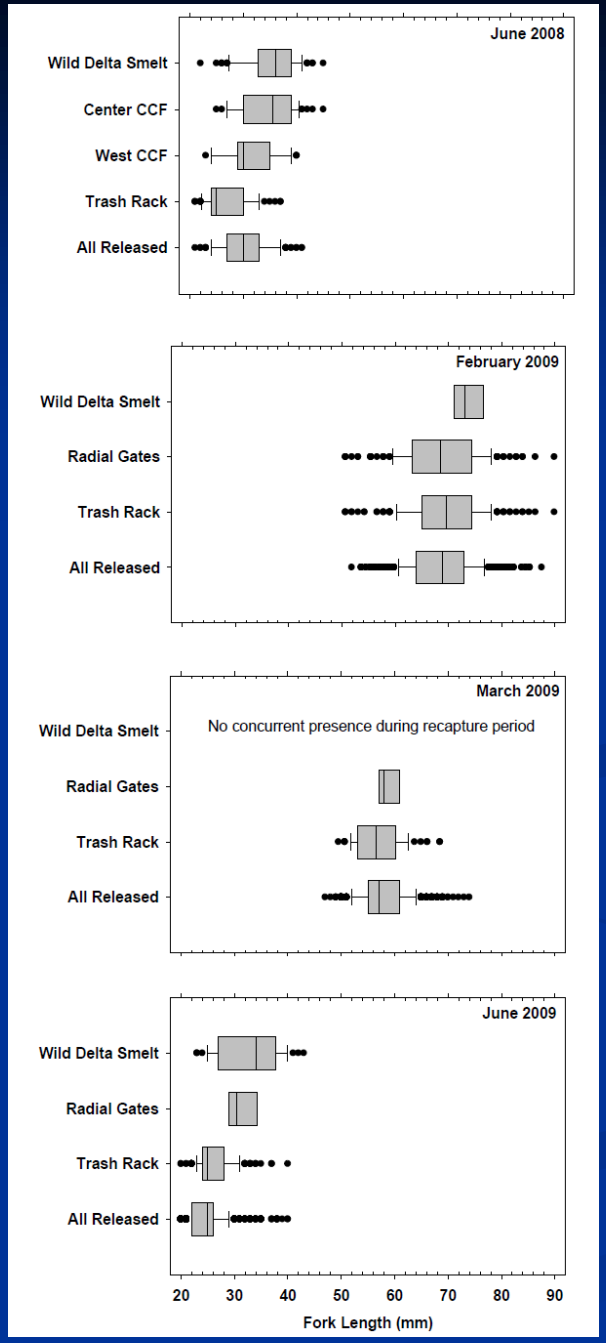


Fish Recovery as a Function of CCF Residence Time



Delta smelt

Size Composition



Juvenile Recaptures June 2008 & 2009*

Recapture	Trash Rack	West CCF	Center CCF	Radial Gates
Percent	24*-30	8	2	0.03*
Days	1	5	7	3*

2009 FIELD RESULTS

Mark-Recapture Estimates	Adults		Juveniles
	February	March	June
% Fish Facity Efficiency	53.25	44.00	24.12
% Recovery	3.01	0.42	0.03
% Pre-Screen Loss	93.59	99.10	99.89
CCF Release to Recovery Ratio[1]	38	237	3603

[1] Total number of fish released in CCF / Total number recovered at SFF.

CONCLUSIONS

1. **Delta smelt can be readily mass-marked to quantify entrainment losses.**

PRELIMINARY CONCLUSIONS

1. **Delta smelt can be readily mass-marked to quantify entrainment losses.**

2. **Pre-screen losses of delta smelt could be much higher at times compared to other species previously studied at the SWP.**

PRELIMINARY CONCLUSIONS

1. **Delta smelt can be readily mass-marked to quantify entrainment losses.**

2. **Pre-screen losses of delta smelt could be much higher at times compared to other species previously studied at the SWP.**

3. **Temporal salvage patterns for delta smelt may not reflect underlying entrainment at SWP.**

Funding Sources

Bay-Delta (CALFED) Science Program

U.S. Bureau of Reclamation

U.S. Fish & Wildlife Service